

# NEW FIBERS

SECOND EDITION

TATSUYA HONGU  
GLYN O. PHILLIPS

# New fibers

2nd edition

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# Preface to the first edition

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This new insight into the world of New Fibers is presented from a Japanese perspective. This deliberate emphasis has arisen for two reasons. First, the basis of the material was the extremely successful Japanese text by Dr Hongu, which has already sold more than 20,000 copies, and is now in its 5th edition. Secondly, the treatment illustrates the unique Japanese approach to technical developments, once the basic break-through has been achieved.

The "super-fibers" which emerged during the 1980s are undoubtedly a chemical and technological triumph. Nevertheless, the excellence of their material properties could not have been given full scope without the imaginative exploitation which has been led by the Japanese. To achieve the aesthetic qualities of natural fur, silk, wool and leather, and to greatly improve on their performance using synthetic materials, require technical mimicry and a fundamental understanding of the properties and manner in which the natural fibers were created. Nature is able to introduce particular structures which impart their own characteristic touch, smell, colour and biological function to biopolymers. This book explains how these processes were studied and subsequently imitated.

The sheer beauty and economy of nature enables complicated polymers first to be fabricated, which then control living processes. The harnessing of these secrets has now led to the availability of new biopolymers which can impart living characteristics into the inanimate. The totality of this chemical, technical, biosynthetic and biomimetic approach has now yielded the high-tech fibers, which find new applications in areas as varied as electronics, medicine, space, nuclear power, the oceans, the earth and the race for perfection in sport.

It is directed mainly at the scientist who is broad in his technical interest and the layman who seeks a glimpse of this brave new world of New Fibers. There is enough information for the specialist to follow up the product and commercial leads which may be relevant to his work, but is not meant,

however, to be a technical manual. Students of fiber science will not find this information collected so coherently elsewhere, and the book could serve as a starting point in their exploration of the subject. To Western scientists and technologists, the Japanese approach might prove a revelation. Above all, we hope the reader enjoys this fascinating subject.

Finally, we would like to acknowledge and thank the persons who have assisted us in the production of this volume. Dr Kanji Kajiwara (Kyoto Institute of Technology) and Ms Machiko Takigami (Gunma University) have given invaluable support in interpreting and translating the Japanese data. Ms Linda Sneddon undertook all the typing and Stephen Williams all the art work. Together these two set out the pages [of the 1st edition] in their final form. We warmly thank our four colleagues for their complete dedication and for giving selflessly of their professional expertise.

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# Preface to the second edition

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We were pleased at the enthusiastic reception given to the 1st edition of *New Fibers*. It was found useful by students and practitioners in fiber science. We were surprised that the demand was so great from colleges in Asia and the Pacific Region, where English is not the first language. This was particularly true for Japan, where students used the book simultaneously to improve their knowledge about New fibers and to communicate their subject in English. The demand soon outstripped the supply, necessitating a new edition. We have taken this opportunity to revise the original and to add new information about developments since 1990, when the 1st edition was published.

Since 1990 there have been considerable changes in the nature of the fibers being produced, the production methods and in consumers' values and expectations. The quantity of fibers produced in the ASEAN countries over this period has increased, whereas the production has decreased in Japan. Nevertheless, it was Japanese fiber technology that continued to drive the new developments. As with the 1st edition we have made an effort to interpret the Japanese viewpoint to a wider audience. Since 1990, the march of High-tech fibers has continued, with an ever-increasing sub-division to meet the specialised applications, as in high-performance, high-function and high-sense fibers.

New research and development has produced fibers with high tenacity and modulus to give the Super-fibers, now used as industrial materials. The more aesthetic and comfortable ways of life have been given rise to the improved and new *Shin-gosen*, the ultra-fine fibers that can emulate the functionality and ambience of biological fibers. It is this springboard that leads on to "fibers for the next millennium", the subject of a new chapter. The new high-tech fibers have also been given a new chapter to bring the subject up to date. Where necessary, statistical information has also been updated.

The synthetic cellulosics have made a particular resurgence since 1990, and the various solvent-spun fibers of the *Lyocell* and *Tencel* families are now

making a great impact on the market. They now offer the processability of synthetics along with the in-built advantages of natural cotton. Accordingly, a new chapter has been added to deal with this subject.

We hope, therefore, that the approach of the 1st edition is now extended to illustrate the dynamism of this frontier industry, pointing the way forward into the next century. It is not primarily directed to specialist fiber technologists, but aims to inform students in fiber science and others who are engaged in the fiber industry and related fields. Students in basic chemistry and physics will find it helpful to give them an insight into this fascinating subject. Above all we hope that the reader enjoys the subject, as we have done during its preparation.

Our two friends Machiko Takigami (now Dr Takigami), Takasaki Radiation Chemistry Research Establishment, Japan Atomic Energy Research Institute and Kanji Kajiwara (now Professor Kajiwara), Kyoto Institute of Technology have greatly assisted us again in preparing this 2nd edition. Both have gained further distinction in the intervening period since 1990. We wish to give them our sincere thanks and also to Stephen Williams who again has helped with the art work. They have given freely of their professional expertise, which has enabled us to communicate across the world and convey the inherent Japanese thinking that has so revolutionised this subject. Finally, we thank Patricia Morrison and Amanda Thomas of Woodhead Publishing Ltd, for ensuring that this new edition sees the light of day.

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